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MINERALOGY AND PETROGRAPHY.¹

The Origin and Classification of Igneous Rocks.—Mr. Iddings² has recently published at length the data upon which are based his conclusions concerning the causes of the different structures exhibited by the igneous rocks of Electric Peak and Sepulchre Mountain and of their varied mineral composition. The main results reached by this study have already been noticed in these pages.³ It may be well again to call attention to the fact that in this region the different conditions attending the final consolidation of the ejected and of the intruded magmas affected not only their crystalline structure, but also their essential mineral composition; consequently, the molecules in a chemically homogenous fluid magma combine in various ways and form quite different associations of silicate minerals, producing mineralogically different rocks. For instance, biotite is an essential constituent of even the most basic of the intrusive rocks, while in the effusive phases it is rarely found in rocks containing less than 61% of SiO_2 . Again, quartz is common in the coarser grained varieties of the former and is absent from those of the latter. Therefore, it is more proper to consider intrusive and effusive rocks that have a like chemical composition as *corresponding* or *equivalent* rocks, than those forms of the two series that have similar mineral compositions. The classification of igneous rocks should recognize the close dependence of structure and mineralogical composition upon geological relations. But, since the structure is the best exponent of these relations, structure should form the basis of this classification. Though giving most of his attention to the general subject of the relation existing between the structure and the geological position of the rocks of the area described, the author devotes a portion of his article to illustrating the intergrowths of hypersthene, pyroxene and hornblende that occur so plentifully developed in the rocks of the region.—In a second paper the same author⁴ attacks the great problem of the origin of igneous rocks. He introduces the subject by outlining the growth of the theory first enunciated by Scrope, that the varieties of igneous rocks are the result

¹Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

²Twelfth Ann. Rep. Director U. S. Geol. Survey, Washington, 1892, p. 569.

³Cf. AMERICAN NATURALIST, April, 1890, p. 360.

⁴The Origin of Igneous Rocks. Bull. Philos. Soc. Wash., xii, 1892, p. 89.

of the differentiation of a homogeneous magma. Scrope's notion was a crude one, but it has been built upon little by little until it has, in the hands of Mr. Iddings, been placed upon a footing secure enough to warrant its being thoroughly tested by observation and experimentation. The author points out the evidences of the close relationships exhibited by the rocks emanating from a volcanic center and their differences from similar groups from other centers, and then takes up the question of the differentiation of molten magmas. He brings forward geological and chemical evidences of the fact of differentiation, and explains the act upon Soret's principle that in a solution whose parts are at different temperatures there will be a concentration of the salt in the colder parts. Lagorio has shown that rock magmas are solutions, and Iddings believes they are solutions of the chemical elements or of their oxides. Consequently, after differentiation has taken place and cooling sets in, different minerals are formed according to laws that depend upon the proportions of the oxides occurring in the differentiated portions. This is apparently contradictory to the view of Rosenbusch,⁵ who regards rocks as having originated in the differentiation of a magma, but of a magma which is a solution of *silicate salts* in a *silicate solvent*. As a result of the condition of affairs suggested by Iddings the first eruption from a volcanic center would naturally possess a composition intermediate between those of succeeding eruptions. As a fact the author states that the sequence is usually a rock of intermediate composition, followed by less siliceous and more siliceous ones, to those very basic and very acid. The last eruptions are of very exceptional character. These will occur in small quantity only, and will be first eroded from the surface. Consequently these forms will be found principally in dykes. They are the forms to which Rosenbusch has given the group name "Ganggesteine." These rocks, according to Iddings, have their equivalents among volcanic flows, but the association of minerals in them is different. It is simply their structure, therefore, that characterizes the dyke rocks. They have originated in the same manner as have other eruptives, and consequently are not essentially different from them. The author's views are developed carefully and at considerable length. They will undoubtedly serve to turn the attention of petrographers to a subject that has lain neglected long enough—the comparative study of rocks of single geological provinces. The paper will well repay very careful reading by all petrographers and theoretical geologists, who should be

⁵AMERICAN NATURALIST, Nov., 1890, p. 1071.

glad to know that it is on sale by the Philosophical Society of Washington, from whose secretary it may be purchased for \$1.

The Novaculites of Arkansas.—In his excellent discussion of the novaculites of Arkansas, Griswold⁶ describes most of these rocks as consisting of very tiny irregular grains of quartz with occasional specks of carbonaceous matter. Originally the rock contained also well crystallized rhombohedra of calcite, traces of which are sometimes seen in the sections. Generally, however, the calcite has entirely disappeared, and its place is now occupied by a rhombic cavity, around which the quartz grains are packed as though they had been shoved about by the crystallizing carbonate. The good cutting qualities of Arkansas whetstones are thought to be due to the presence of these cavities. The purity of the Hot Springs novaculite is shown by an analysis that yielded :

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	K ₂ O	Na ₂ O	Loss	Total
99.45	.26	.12	tr.	.19	.54	.06	=100.62	

According to the author the rocks were first deposited as a mud or ooze, in which calcite crystallized. They were then consolidated by simple pressure, and finally, after upturning and erosion, they were supplied with a small quantity of secondary silica.

Petrographical News.—Osann⁷ has discovered that the mineral heretofore regarded as sodalite in the Montreal eleolite-syenite is nosean, as it contains 5-6% of SO₄, and very little calcium. It is quite abundant in the rock, and is included as idiomorphic grains in its garnets. A microscopical test proposed by the author for distinguishing between nosean and sodalite is as follows: Moisten slide with dilute acetic acid to which a little barium-chloride has been added, and allow to stand in an atmosphere of the acid. Sodalite remains transparent, while nosean is covered with an opaque coating of barium sulphate.

The coloring matter of the black limestone of the Pyrenees is shown by Jannetaz⁸ to be carbon, probably in the form of anthracite.

The new catalogue of geology and petrography issued by Ward's Natural Science Establishment, of Rochester, N. Y., deserves mention

⁶Ann. Rep. Geol. Survey of Ark. for 1890, Vol. iii, pp. 122-168.

⁷Neues Jahrb. f. Min., etc., 1892, i, p. 222.

⁸Bull. Soc. Franç d. Min., xv, 1892, p. 101.

in these notes because of the full list of rock names contained in it. The principal rock types are defined, and under each are given the technical names of all its varieties. It is further interesting as an indication of the growing importance of lithology in this country, since it is quite evident that Prof. Ward would not find it advisable to keep in stock such a large quantity of rock material were the demands for it rare. The catalogue may well serve the geologist as a table of petrographical synonyms.

A New Occurrence of Ptilolite.—A new occurrence of *ptilolite* has been discovered by Cross and Eakins⁹ in Custer County, Col., about three miles southeast of Silver Creek, in the vesicles of a dull green devitrified pitchstone. The mineral is in very slender needles that are optically negative. An analysis made on very carefully selected material gave:

SiO ₂	Al ₂ O ₃	CaO	K ₂ O	Na ₂ O	H ₂ O	Total
67.83	11.44	3.30	.64	2.63	13.44	=99.28,

which is equivalent to $R_7 Al_2 Si_{10} O_{24} + 6\frac{2}{3} H_2O$, a formula identical with that determined for mordenite by Pirsson.¹⁰ Clarke¹¹ regards a part of the water in each mineral as basic, and believes that mordenite, the ptilolite from Silver Creek and the original ptilolite (which is poor in Na₂O) are mixtures of the salts. $Al_2 (Si_2O_5)_5 Ca H_2 \cdot 3Aq$, $Al_2 (Si_2O_5)_5 Ca H_2 \cdot 6Aq$, $Al_2 (Si_2O_5)_5 Na_2 H_2 \cdot 6Aq$ and $Al_2 (Si_2O_5)_5 K_2 H_2 \cdot 6Aq$.

Mineralogical News.—*Polybasite* and *tennantite* are reported by Penfield and Pearce¹² from the Mollie Gibson Mine in Aspen, Col. The former is the ore of the mine. It occurs massive, often associated with barite and siderite. It is of a grayish-black color, and has disseminated through it patches of the lighter tennantite. Analyses, corrected for impurities, follow:

	S	As	Sb	Aq	Pb	Cu	Zn	Fe
Polybasite.....	18.13	7.01	.30	56.90		14.85	2.81	
Tennantite...	25.04	17.18	.13	13.65	.86	35.72	6.90	.42

Crystals of both minerals are known to occur in several of the Colorado mines, though they have not yet been described.

⁹Amer. Jour. Sci., August, 1892, p. 96.

¹⁰Cf. AMERICAN NATURALIST, 1891, p. 372.

¹¹Amer. Jour. Sci., August, 1892, p. 101.

¹²Amer. Jour. Sci., July, 1892, p. 15.

The *cerussite* from Pacaudière, near Roanne, Loire, France, is stated by Gonnard¹³ to be associated with copper, silver and lead compounds, pyrite, limonite, quartz and calcite. Its simple crystals present a large variety of planes. Twinned crystals are common, and trillings are known. A description of the several types is given by the author. For sixty years past the same mineral has been known to occur at the argentiferous galena mines of Pontgibaud Puy-de-Dôme, but the fact has not been noted in the treatises on Systematic Mineralogy. All the crystals seem to have been formed at the expense of galena and bour-nonite by the action of CO₂ from the neighboring volcanic vents. The habit of its crystals is well described by Gonnard¹⁴.

Morenosite [(Ni Mg) SO₄ + 7H₂O] in green stalactites from the foot of the Breithorn in Zermatt, yielded the same mineralogist¹⁵ the figures SO₃ = 28.7; NiO = 18.5; MgO = 6.5; H₂O = 46.5. A single fragment of an ochre-yellow mineral from New Caledonia is a silicate of nickel, magnesium and iron:

SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	NiO	MgO	H ₂ O	Total
33.0	18.5	1.5	26.3	8.0	14.0	= 101.3

Frossard¹⁶ substantiates the statement of Mallard that the black garnet *pyreneite* is a grossularite and not a melanite as reported by Raymond. Its density varies between 3.375 and 3.53.

Vesuvianite is reported by Pisani¹⁷ from Settino in the Rhetian Alps. Its analysis gave:

SiO ₂	Al ₂ O ₃	FeO	CaO	MgO	MnO	Loss	Total
39.0	14.3	1.8	37.4	6.7	tr.	.9	= 100.1

The supposed *martite* crystals in the rock of Cuzeau, Mont Doré, are tabular hematites cemented into octahedra by magnesio-ferrite, as determined by Lacroix.¹⁸

In the basic clays of Condorcet near Nyons, Drôme, France, are boulders of siliceous limestone, with cavities whose walls are lined with bi-pyramidal quartz crystals, transparent *celestite*, *dolomite* and *calcite*. The quartz and celestite both contain rare planes beautifully developed.¹⁹

¹³Bull. Soc. Franç. d. Min., xv, 1892, p. 35.

¹⁴Ib., xv, p. 41.

¹⁵Ib., xv, p. —.

¹⁶Ib., xv, p. 58.

¹⁷Ib., xv, p. 47.

¹⁸Ib., xv, p. 11.

¹⁹Ib., xv, p. 27.

Mineral Syntheses.—Bourgeois and Traube²⁰ having failed to produce *carbonates of the magnesium* group of elements by the reaction of urea, water and metallic chlorides on each other at 130° in sealed tubes, have made another attempt at their synthesis by substituting potassium cyanate for the urea. The attempt proved successful, needles of *aragonite* and rhombohedra of *dolomite* and *magnesite* having been produced under the conditions mentioned, when the chloride used was a mixture of the magnesium and calcium salts in molecular proportions.

By the slow action of dilute solutions of copper chloride upon freshly precipitated lead hydroxide at ordinary temperatures there is produced a blue powder consisting of octahedra and cubes of *percyllite*, with which are associated quadruple twins of a colorless mineral supposed by C. Friedel²¹ to be *phosgenite*.

Crocoite has been obtained by Ludeking²² upon allowing a strong solution of caustic potash to stand for some time in contact with lead chromate in the presence of a little potassium chromate. By using a large excess of very strong caustic potash *phaenicochroite* forms. The crystallization of the latter substance is due to the abstraction of the solvent by the carbon-dioxide of the air, and of the former by a further reaction between the caustic potash and chromic acid.

New Minerals.—*Penfieldite*.—This mineral, discovered by Prof. Genth²³ on the slags from Laurion, Greece, is evidently produced by the action of sea water upon the materials of the slag. It is usually in the form of hexagonal prisms with basal planes, or in prisms tapered by pyramids. The color is white and the lustre vitreous to greasy. An analysis of the tapering crystals gave: Cl = 18.55, Pb = 78.25, O = —, indicating the formula Pb O. 2Pb Cl_2 .

Brazilite is a new tantalum-niobate from the iron mine Jacupiranga, in S. São Paulo, Brazil. Hussak²⁴ describes it as occurring in the magnetite-pyroxene rock called by Derby jacupirangite. It was separated by washing the decomposed residue of this rock in a miner's pan, and has heretofore been taken for orthite. Its crystallization is monoclinic with $a : b : c = .9859 : 1 : .5109$. $\beta = 98^\circ 45\frac{1}{2}'$. The forms observed in its crystals are $\infty\text{P}\overline{\infty}$, ∞P , $\infty\text{P}2'$, $-\text{P}\overline{\infty}$, oP , $\text{P}\overline{\infty}$,

²⁰Ib., xv, 1892, p. 13.

²¹Ib., xv, 1892, p. 96.

²²Amer. Jour. Sci., July, 1892, p. 57.

²³Amer. Jour. Sci., 1892, p.

²⁴Neues. Jahrb. f. Min., etc., 1892, ii, p. 141.

$2P \propto^1$, P and $-P$. The crystals are tabular parallel to the orthopinacoid and are nearly always twinned, frequently yielding very complicated groupings. The color of the larger crystals varies from sulphur-yellow to black. Their hardness is 6.5 and density 5.006. The plane of their optical axes is parallel to the clinopinacoid, and the double refraction is negative. The extinction is 8° – 15° in obtuse β , and the pleochroism varies between dark-brown and oil-green. The minerals associated with brazilite are apatite, magnetite, perovskite, ilmenite, and a spinel. An analysis of the new minerals is promised shortly.

Landauer's Blowpipe Analysis.—This little book²⁵ will be cordially welcomed by English and American teachers in colleges in which the use of a large manual of blowpipe analysis is undesirable. It is as suitable for classes in mineralogy as in chemistry, since it will enable the student to determine the composition of a mineral as rapidly as will the use of the great majority of Determinative Mineralogies upon the market. Moreover, it possesses one desirable advantage over those schemes in which the hardness, color and streak of chemical compounds are made to serve as distinctive tests for them, in that it compels the experimenter to study the chemical nature of the substance with which he is working. A mineral is a definite chemical substance. A student of mineralogy who is unfamiliar with the composition of bodies with which he is working, though he may know considerable about their physical properties, is neglecting the foundation upon which his knowledge of minerals must rest. The little book before us is an excellent introduction to the larger works like those of Brush and Plattner. It is, besides, complete enough for most of the purposes to which such a book is usually put. Beginning with a good description of the apparatus and reagents necessary to blowpipe manipulation, it follows with an account of the operations employed, describes Bunsen's flame reactions, mentions the distinctive tests for the various chemical elements, gives Landauer's and Egleston's schemes for the systematic examination of inorganic substances, and closes with tables exhibiting the reactions of the various metallic oxides, and in a condensed form the results of the different operations described in the text. The book must find a place in many laboratories.

²⁵Blowpipe Analysis, by J. Landauer. Authorized English Edition by James Taylor. Second Edition. Macmillan & Co., 1892, pp. 14 and 173.